

Progress on the assessment of the taxonomic status of the circum-Mediterranean genus *Atyaephyra* de Brito Capello, 1867 (Decapoda: Atyidae)

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Introduction

A review of the relevant literature (e.g., Holthuis, 1961; Anastasiadou *et al.*, 2006-2008) indicates that the taxonomic status of the circum-Mediterranean genus *Atyaephyra* is still confusing and uncertain.

The given descriptions of taxa already assigned to this genus (e.g. Millet, 1831; De Brito Capello, 1867; Bouvier, 1913; Holthuis, 1961; Karaman, 1972; Al-Adhub, 1987) are incomplete and suffer from overlapping morphological features. Furthermore, most of these descriptions were based on few specimens collected from a limited numbers of sampling localities that didn't certainly cover the alleged distributional range of the genus.

Based on the above, the aim of this study is to clarify the taxonomic status of the genus *Atyaephyra*.

Material and Methods

Numerous specimens from many different localities of Europe and the circum-Mediterranean region were examined (Fig. 1). The specimens were acquired from Museum and private collections of researchers as well as from first author's field surveys. In order to detect possible differences among the various populations, a total of 135 morphological features were studied. All the features were then analyzed and compared with the PASW Statistics 18 software package for Windows. In this analysis, only the adult individuals were taken into account in order to exclude deviations in the features which appear in the juvenile individuals. Through this analysis, the ranges of variation of the different characteristic features among the studied populations were estimated and were compared. This comparison revealed non-overlapping or partly overlapping features among the different *Atyaephyra* populations. These data led to the identification of new key features (Table 1) which permitted the creation of a key for the distinction of the studied taxa (Fig. 2).

Results-Discussion

Based on the morphological analysis of the examined populations the following six different taxa were distinguished: *Atyaephyra desmarestii* (Millet, 1831), *Atyaephyra* n.sp. 1, *Atyaephyra* n.sp. 2, *Atyaephyra* n.sp. 3, *Atyaephyra* n.sp. 4 and *Atyaephyra desmarestii orientalis* species complex. The geographical distribution of these six taxa is given in Figure 1 and the selected key features that distinguish them are given in Table 1. Furthermore, a key for the distinction of these six taxa is given in Figure 2.

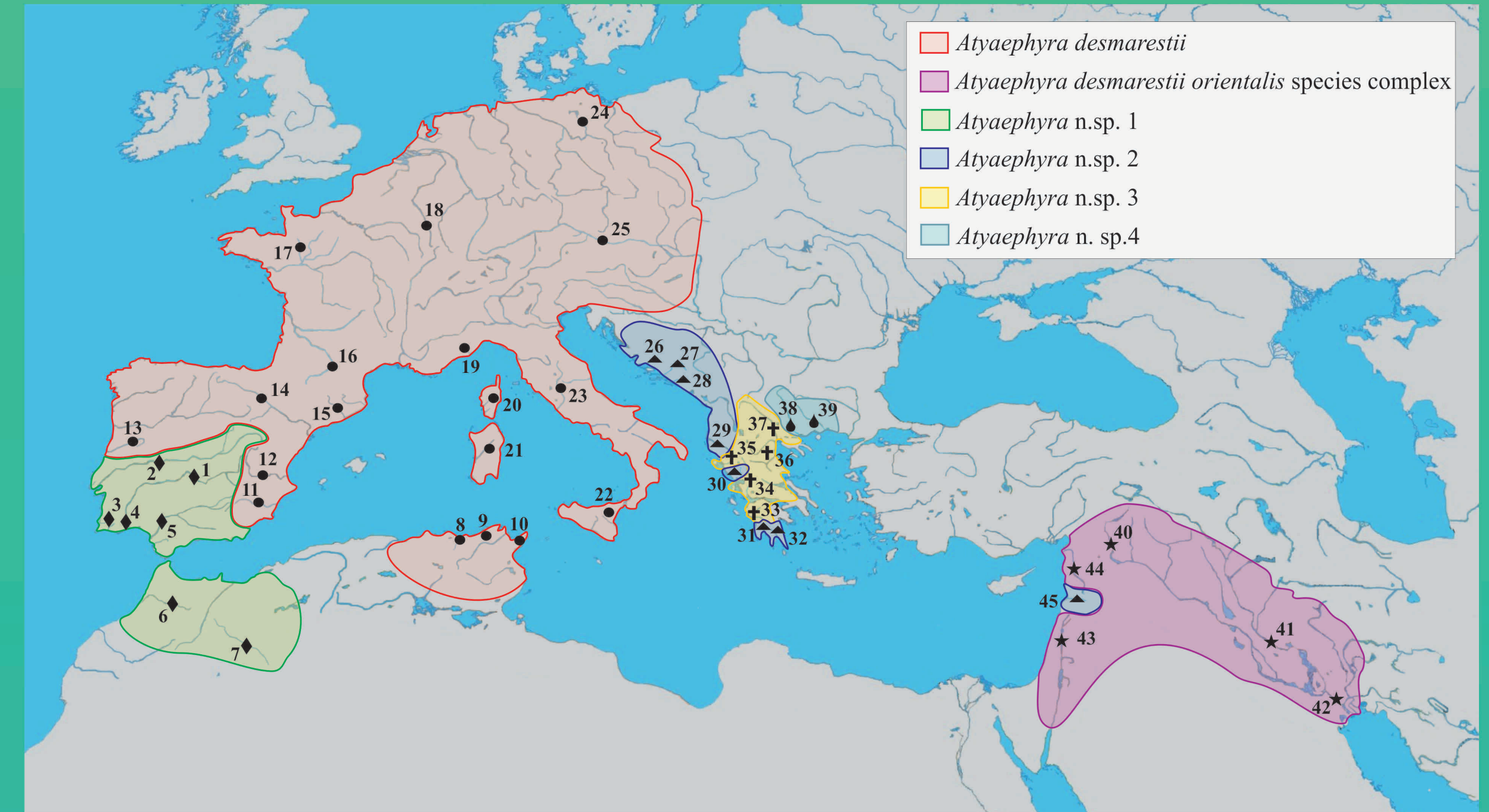
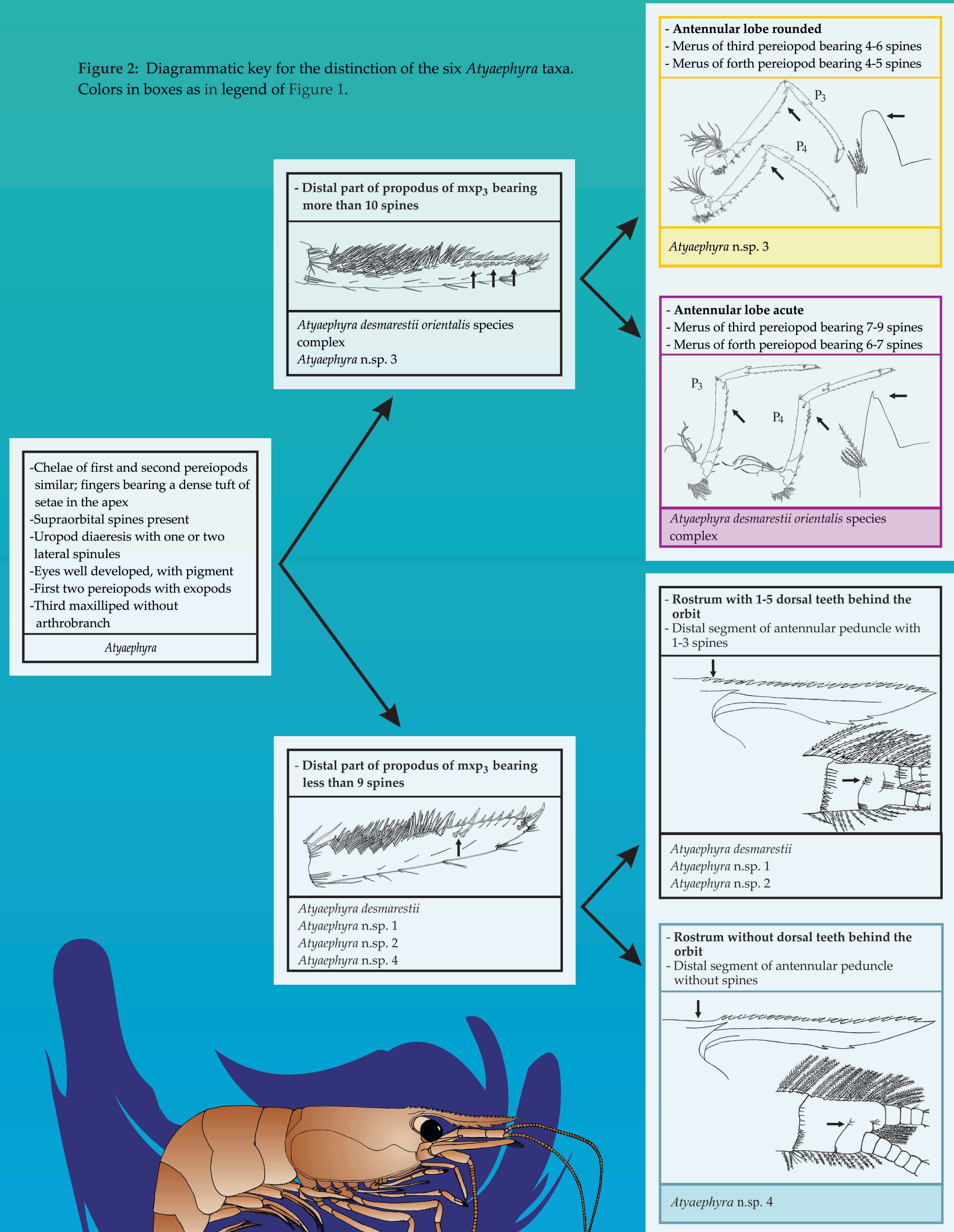


Figure 1: Geographical distribution of the six different taxa. Numbers indicate the main river basins from which specimens of the genus *Atyaephyra* originate. *Atyaephyra* n.sp. 1 (◆): 1, Guadiana River, Spain - Portugal; 2, Tagus River, Spain - Portugal; 3, Bordeira River, Portugal; 4, Odelouca River, Portugal; 5, Guadalete River, Spain; 6, Krumane River, Morocco; 7, Saoura River, Algeria. *Atyaephyra desmarestii* (●): 8, Seybouse River, Algeria; 9, Barrage Ben Metir, Tunisia; 10, Barrage Lebna, Tunisia; 11, Segura River, Spain; 12, Júcar River, Spain; 13, Mondego River, Spain; 14, Ebro River, Spain; 15, Llobregat River, Spain; 16, Garrone River, France; 17, Loire River, France; 18, Meuse River, Belgium; 19, Centa River, Italy; 20, Corsica; 21, Sardinia; 22, Sicily; 23, Tiber River, Italy; 24, Elbe River, Germany; 25, Danube River, Austria. *Atyaephyra* n.sp. 2 (▲): 26, Jadro River, Croatia; 27, Krupa River, Bosnia and Herzegovina; 28, Ombla River, Croatia; 29, Aaos River, Albania; 30, Acherontas River, Greece; 31, Pamisos River, Greece; 32, Evrotas River, Greece; 45, Nahr al Kabir River, Syria. *Atyaephyra* n.sp. 3 (⊕): 33, Alfios River, Greece; 34, Acheloos River, Greece; 35, Thyamis River, Greece; 36, Pineios River, Greece; 37, Axios River, Greece. *Atyaephyra* n.sp. 4 (♣): 38, Strymonas River, Greece; 39, Nestos River. *Atyaephyra desmarestii orientalis* species complex (★): 40, Euphrates River, Syria - Iran; 41, Tigris River, Iran; 42, Shatt Al-Arab River, Iran; 43, Jordan River, Israel - Palestine - Jordan; 44, Orontes River, Syria - Turkey.

Table 1: Comparison of the key morphological features of the six taxa of the genus *Atyaephyra*. For each morphological feature, the absolute range of variation in all individuals studied is given, along with the variation in the bulk of the studied specimens. The red and green colors are used for the contradistinction of the features. NI, number of individuals.

	<i>Atyaephyra desmarestii</i> (Millet, 1831) (◆)	<i>Atyaephyra</i> n.sp. 1 <i>Atyaephyra rosiana</i> , Anastasiadou <i>et al.</i> , 2008 (◆)	<i>Atyaephyra</i> n.sp. 2 <i>Atyaephyra desmarestii</i> , Anastasiadou <i>et al.</i> , 2008 (in part) (▲)	<i>Atyaephyra</i> n.sp. 3 <i>Atyaephyra desmarestii stankoi</i> , Karaman, 1972 <i>Atyaephyra desmarestii</i> , Anastasiadou <i>et al.</i> , 2008 (in part) (⊕)	<i>Atyaephyra</i> n.sp. 4 (♣)	<i>Atyaephyra desmarestii orientalis</i> species complex (★)
Rostrum	Dorsal teeth behind the orbit 1-5 (NI: 261) 2-4: 93.1 %	0-5 (NI: 152) 1-3: 91.4 %	0-3 (NI: 100) 1-3: 86.0 %	0-3 (NI: 127) 1-3: 89.0 %	0 (NI: 74) 0: 100 %	0-3 (NI: 89) 1-3: 88.8 %
Telson	Dorsolateral pairs of spines 2-4 (NI: 255) 2-3: 91.0 %	3-4 (NI: 145) 4: 63.5 %	3-5 (NI: 96) 4-5: 91.7 %	3-8 (NI: 121) 5-7: 95.0 % (115)	2-7 (NI: 71) 3-4: 91.5 %	3-6 (NI: 84) 4-5: 92.8 %
Antennular peduncle	Shape of lobe on proximal segment round: 93.3 % (NI: 154) acute: 6.7 % (NI: 11)	round: 85.5 % (NI: 118) acute: 14.5 % (NI: 20)	round: 99.0 % (NI: 99) acute: 1.0 % (NI: 1)	round: 99.2 % (NI: 125) acute: 0.8 % (NI: 1)	round: 97.2 % (NI: 74) acute: 2.8 % (NI: 2)	round: 4.5 % (NI: 4) acute: 95.5 % (NI: 84)
Maxilla	Spines on distal segment 0-2 (NI: 201) 1-2: 96.5 %	0-2 (NI: 142) 1-2: 85.2 %	1-3 (NI: 100) 1-2: 92.0 %	1-6 (NI: 126) 1-4: 96.8 %	0-1 (NI: 74) 0: 86.5 %	0-3 (NI: 89) 1-2: 94.4 %
3rd Pereiopod	Rows of simple setae on basipodial endite 16-22 (NI: 257) 18-21: 89.9 %	14-20 (NI: 146) 15-17: 76.1 %	17-21 (NI: 99) 18-21: 92.9 %	12-16 (NI: 126) 13-16: 96.8 %	12-17 (NI: 74) 13-16: 90.5 %	11-16 (NI: 87) 12-15: 90.8 %
4th Pereiopod	Basipodial / endite length 1.39-1.70 (NI: 237) 1.49-1.62: 86.1 %	1.55-1.85 (NI: 138) 1.63-1.84: 73.9 %	1.51-1.61 (NI: 97) 1.52-1.60: 96.9 %	1.78-2.24 (NI: 122) 1.84-2.05: 95.1 %	1.74-1.95 (NI: 74) 1.78-1.95: 95.9 %	1.75-2.20 (NI: 83) 1.81-2.07: 91.6 %
Mxp3	Lateral spines on propodus 0-8 (NI: 256) 1-5: 93.4 %	0-8 (NI: 135) 2-7: 91.1 %	1-6 (NI: 98) 2-5: 93.9 %	11-38 (NI: 124) 16-30: 88 %	1-7 (NI: 74) 1-7: 100 %	10-32 (NI: 85) 14-27: 83.5 %
3rd Pereiopod	Spines on merus 2-7 (NI: 177) 3-5: 97.2 %	2-7 (NI: 125) 3-5: 92.0 %	3-6 (NI: 96) 3-5: 96.9 %	3-8 (NI: 126) 4-6: 88.9 %	3-6 (NI: 72) 3-5: 90.3 %	6-13 (NI: 86) 7-9: 86.0 %
4th Pereiopod	Spines on merus 2-6 (NI: 176) 3-5: 97.7 %	3-6 (NI: 128) 3-5: 99.2 %	3-5 (NI: 96) 3-4: 92.7 %	2-6 (NI: 124) 3-5: 92.8 %	3-5 (NI: 71) 3-5: 100 %	5-9 (NI: 87) 6-7: 80.5 %

Figure 2: Diagrammatic key for the distinction of the six *Atyaephyra* taxa. Colors in boxes as in legend of Figure 1.



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